

## Quality Designator: Provisional

This statement applies to MISR Level 2 Aerosol/Surface Products for September 25, 2002, and beyond until such a time as further improvements to MISR software are made. See the [Versioning Page](#) for an in-depth explanation of the differences between various MISR product versions. [Quality statements covering earlier time periods](#) are accessed through links at the bottom of this page.

An extensive review of product quality has not yet been performed. Please read the [summary words of caution](#) if you have not done so already.

In spite of warnings relating to Beta and Provisional quality parameters, the MISR Level 2 Aerosol/Surface software which generated these products is believed to be functioning quite well except where noted below. This statement highlights major known problems and issues with the products, as well as functionalities which are currently not implemented.

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[Aerosol](#) | [Land](#) | [Ocean](#)

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## AEROSOL (a.k.a. AS\_AEROSOL, MIL2ASAE) (generated by MISR PGE9 executables)

### PRODUCT MATURITY

All aerosol parameters now have the "Provisional" status with the exception of

ChisqHomog,  
OptDepthHomogCalcPerBand,  
ChisqHomogCalcPerBand,

which have "Beta" status and

RegBestFitMixtureEqRefl,  
RegSfcRetrOptDepthUnc,  
OptDepthDWCalcPerBand,  
OptDepthOTACalcPerBand,  
ChisqAbsCalcPerBand,

which are not yet implemented.

Product users should be aware that the aerosol models used in the retrieval analyses provide a practical means of allowing a determination of optical depth, and some preliminary validations of optical depth have been performed, as described below. However, it has not yet been verified that any particular model which successfully fits the observations should necessarily be considered an indicator of the actual aerosol type. As the MISR retrieval process matures, the constraints and thresholds used will be tightened, resulting in a decrease of the number of successful aerosol models for any particular retrieval. This process, coupled with a more rigorous comparison of MISR and ground truth data (AERONET and field campaigns) which includes aerosol particle size distribution and other microphysical properties, will determine how and to what extent the model results can be interpreted. Both activities are in progress.

### ACP DEPENDENCY

The quality of the aerosol product depends upon the quality of the Ancillary Climatology Product (ACP). The ACP contains information on component aerosol particle properties and mixtures of aerosol components assumed by the retrieval algorithm. The ACP was updated in April 2002 with a new aerosol component dataset and a new mixture dataset. Refer to the [ACP quality statement](#) for further information.

### TASC DEPENDENCY

The MISR TASC (Terrestrial Atmosphere and Surface Climatology) dataset provides information on the climatological conditions of the area being observed by the MISR instrument. This information is used during the aerosol retrieval process. The TASC dataset is gridded on a month-by-month temporal basis. We anticipate that in a future upgrade, this information will be obtained from more timely sources, e.g., the Data Assimilation Office (DAO).

### CLOUD DETECTION STATUS

Cloud screening is performed prior to the aerosol retrievals. However, the masks currently used do not detect some clouds. The user is cautioned to be aware of this. Most of the detection blunders tend to occur on the edges of well-defined clouds, causing the water or land aerosol retrieval algorithm to be used improperly. These blunders manifest themselves as large values for the aerosol optical depth ( $> 2$ ). Cloud screening is currently performed with algorithms which use the angle-to-angle differences in radiances across MISR cameras, as well as with the MISR-derived Radiometric Camera-by-camera Cloud Mask (RCCM) and Stereoscopically Derived Cloud Mask (SDCM).



Improvements to the cloud detection scheme are currently under study.

#### **RELIABILITY OF AEROSOL OPTICAL DEPTHS OVER LAND**

Comparisons of MISR optical depths with those from AERONET (ground based) show a good correlation between the two datasets. These comparison studies are currently in the preliminary stages but are expected to be more extensive in the near future. Nevertheless, it appears that MISR optical depths over land are currently biased high by about 15% when compared to AERONET values. Numerous reasons for this bias have been suggested and considerable effort is being expended in exploring these ideas. The retrieval results over land have improved in both coverage and quality as a consequence of tuning up the heterogeneous land aerosol retrieval algorithm, although much still remains to be done in this area. In particular, minor populations of retrieval blunders sporadically occur for terrain types having low spatial contrast, most notably bright deserts and snow/ice fields. They manifest themselves as anomalously large values of optical depth ( $> 2$ ), which appear to be randomly scattered throughout an area. Increased numbers of blunders occur over snow/ice fields as a consequence of inadequate cloud screening. Blunder elimination is a high priority ongoing task.

#### **RELIABILITY OF AEROSOL OPTICAL DEPTHS OVER WATER**

MISR optical depths over water are generally larger than those from AERONET (ground based), typically by  $\sim 0.05$ . This is a consequence of three factors: 1) the water is not sufficiently dark at those AERONET sites which are situated on the coast, 2) MISR data have not been sufficiently processed to exclude the effects of the instrumental point spread and optical scattering functions, and 3) the MISR radiometric calibration appears to bias the radiances too high by  $\sim 5\%$ . Away from bright land, clouds and ice, the effects from factors 1) and 2) are substantially reduced. All three factors, with particular emphasis on 2) and 3), are currently being investigated, and corrections for 2) and 3) will be implemented in the fall of 2002.

#### **OPTICAL DEPTH UNCERTAINTIES**

Estimates of the uncertainty in the aerosol optical depth over land have been improved by application of more stringent constraints on the heterogeneous land aerosol retrieval algorithm. Previous estimates were too large due to lack of use of spectral information. Uncertainty estimates for aerosols over dark water remain the same as for earlier versions of the algorithm.

#### **EDGE-OF-SWATH ARTIFACTS OVER OCEAN**

The retrieved optical depths over ocean at the edge of the MISR swath occasionally appear brighter than the surrounding values. The cause of this artifact is under investigation.

#### **ALGORITHM UPDATES**

The aerosol retrieval algorithms described in the Algorithm Theoretical Basis document (Revision E, April 2001) have been modified and improved, based on initial analyses of the data. The next release of this document will include an updated description of these algorithms.

#### **EXPERIMENTAL AEROSOL ALGORITHM OVER HOMOGENEOUS SURFACES**

A new algorithm which retrieves aerosol properties over homogeneous surfaces is included. However, due to its experimental nature, results from this algorithm are included for diagnostic purposes only. Affected fields in the aerosol product are ChisqHomog, OptDepthHomogCalcPerBand, and ChisqHomogCalcPerBand.

#### **SOME AEROSOL FIELDS NOT AVAILABLE**

The following fields in the aerosol product are not currently computed, and contain fill only: RegBestFitMixtureEqRefl; RegSfcRetrOptDepthUnc; OptDepthDWCalcPerBand; OptDepthOTACalcPerBand; ChisqAbsCalcPerBand.

## **LAND SURFACE (a.k.a. AS\_LAND, MIL2ASLS) (generated by MISR PGE9 executables)**

#### **PRODUCT MATURITY**

All surface parameters now have the "Provisional" status with the exception of

BHRPAR,  
DHRPAR,  
BHRPARNumSubrCalcUsed,  
DHRPARNumSubrCalcUsed,  
LAIMean1,  
LAIDelta1,  
LAINumGoodFit1,  
LAIMean2,  
LAIDelta2,  
LAINumGoodFit2,  
FPAR,  
FPARVar,  
FPARModalUnc,  
FPARNumSubrCalcUsingRet,  
FPARNumSubrCalcUsingDef,  
FPARFreqOccurScfType,

which have "Beta" status.



## **AEROSOL DEPENDENCY**

The land surface product relies on the aerosol product for atmospheric correction information. Therefore, the quality of the land surface product depends upon the quality of the aerosol product, and users are advised to refer to the aerosol product for further information. In the future we anticipate replicating the appropriate aerosol information within the land surface product.

## **RELIABILITY OF LAND SURFACE REFLECTANCE VALUES DEPENDENT UPON AEROSOL OPTICAL DEPTH MAGNITUDE**

At the current time land surface retrievals, particularly those with low surface albedo, should be considered most reliable when the aerosol optical depths are small ( $< 0.2$ ). For higher albedo areas, such as deserts, good results are obtained for optical depths  $< 0.4$ ). Thus, it is recommended that users examine the 'RegSfcRetrOptDepth' field in the Aerosol Product as part of their assessments of the surface parameters. This field is the aerosol optical depth at 558 nm (green band), used in the surface retrieval process. Other parameters which indicate the quality of the surface retrieval include 'LandBHRRelUnc' (ratio of BHR uncertainty to BHR value) and 'LandHDRFUncCamAvg' (HDRF uncertainty averaged over the various cameras), which are derived from the uncertainty in the retrieved aerosol optical depth. It can be assumed that these uncertainty products also apply to the DHR and BRF surface products, respectively. Inspection and analysis of these products, for both dark and bright areas, indicates that they adequately represent the uncertainty associated with their respective products, and therefore are good indicators of product quality. Some sporadic but obvious retrieval blunders do occur, however, for areas that are bright and have little contrast (e.g., deserts and snow/ice fields) and these are easily seen in the images as anomalously bright reflectances. Further refinements in the quality of the aerosol retrievals over land are planned for future releases and these are expected to result in improvements in the surface retrieval blunder rate and product quality at larger optical depths.

## **QUILTING EFFECT IN LAND SURFACE REFLECTANCES**

Most of the retrieved land surface reflectances are reported at a 1.1 km x 1.1 km spacing, whereas the retrieved aerosol optical depths are computed at a coarser 17.6 km x 17.6 km spacing. It is assumed that aerosol amount is constant over any particular 17.6 km region, which results in values of aerosol optical depth that are inherently discontinuous going from one region to an adjacent one. Therefore, the atmospheric correction process, using the coarse resolution aerosol data with the fine resolution reflectance data, occasionally produces a distinctive "quilting" effect in the directional surface reflectance imagery, i.e., a discernable block pattern. Imagery from the extreme off-nadir cameras at 446 nm (blue band) is particularly prone to this effect. The aerosol optical depth discontinuities are due to both real variation in aerosol amount on spatial scales smaller than the 17.6 km spacing and to intrinsic uncertainties associated with the aerosol retrieval process. The magnitude of this "quilting" effect is well described by the surface reflectance uncertainty parameters, mentioned in the previous section.

## **FILL VALUES IN LAND SURFACE REFLECTANCES**

Land surface reflectances are computed separately for each MISR spectral band. In some cases, the land retrievals succeed in one MISR band, but not another. This can cause visualization problems when viewing a composite image of land surface reflectances which contains spectral bands for both successful and unsuccessful retrievals. This occasional algorithm failure in certain bands (notably blue and/or red) is thought to be due to a software error and is a high priority item for investigation and repair.

## **LAI/FPAR AVAILABILITY AT BETA QUALITY LEVEL**

The LAI/FPAR fields are now of "Beta" quality. The software which computes leaf-area index (LAI) and fraction of photosynthetically active radiation (FPAR) uses Land Surface Reflectances (BHR and BRF) as input. Two spectral bands, red and near-infrared, and 7 view directions are currently used to produce LAI and FPAR. The quality and spatial coverage of LAI and FPAR depend on the quality and coverage of the Land Surface Reflectances. Dense vegetations exhibit low reflectances at red and blue spectral bands. High uncertainties in BHR retrievals over dark surfaces (see section "RELIABILITY OF LAND SURFACE REFLECTANCE VALUES DEPENDENT UPON AEROSOL OPTICAL DEPTH MAGNITUDE") can result in algorithm failure, reducing the number of successful LAI/FPAR retrievals. Inspection and analysis of the Beta LAI/FPAR product, however, indicate that the successfully retrieved LAI/FPAR values follow regularities expected from physics. We believe that the algorithm does not produce LAI/FPAR values if the input is unreliable. Improvements to the quality of the Land Surface Reflectances, therefore, will lead to better spatial coverage. Uncertainties in the LAI/FPAR product are under investigation.

## **OCEAN (a.k.a. AS\_OCEAN, MIL2ASOS) (from MISR PGE9)**

### **OCEAN NOT YET AVAILABLE**

The Ocean Surface product, which contains surface reflectance properties over ocean, has not yet been implemented. It is unavailable at this time.

Also see:

- [Statement dated July 29, 2002](#) for MISR Level 2 Aerosol/Surface Products from July 29, 2002 to September 24, 2002.
- [Statement dated April 15, 2002](#) for MISR Level 2 Aerosol/Surface Products from April 15, 2002 to July 28, 2002.
- [Statement dated September 27, 2001](#) for MISR Level 2 Aerosol/Surface Products from September 27, 2001 to April 14, 2002.
- [Statement dated March 30, 2001](#) for MISR Level 2 Aerosol/Surface Products from March 30, 2001 to September 26, 2001.
- [Statement dated February 16, 2001](#) for MISR Level 2 Aerosol/Surface Products from February 16 to March 29, 2001.

